Naval Aerospace Medical Research Laboratory

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A COST-BENEFIT ANALYSIS OF THE IMPACT OF SELECTION TESTING ON ADVANCED FLIGHT TRAINING

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ABSTRACT

This report presents a numerical example showing how selection testing can reduce costs in advanced T-45 training. Selection testing provides savings by reducing the rate of attrition. With reduced attrition, fewer students are required to enter the training curriculum to achieve a set number of graduates to fill operational seats. Balanced against this positive impact are at least three factors associated with selection testing that must be taken into account in any cost-benefit analysis. These are 1) R&D costs, 2) administrative costs, and 3) costs associated with rejecting qualified applicants. It is shown that, under certain readily quantifiable circumstances, selection testing might save over $2 million per T-45 advanced strike class. The major goal of this report is to provide a quantitative framework for the rational discussion of selection tests as a prelude and partner to military training curricula.

Acknowledgments

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INTRODUCTION

The main purpose of this report is to show how selection testing can have a proven, quantifiable impact on reducing costs for a specific advanced flight training pipeline. The argument is conducted in the form of a numerical example using actual dollar cost data. The **advanced strike** curriculum was chosen as the focus for this numerical example because of the combination of high percentage of failures and the large cost of each failure. Conservative cost per attrition data for various pipelines are presented in Table 1. (Because of traditional Navy usage, "attrition" and "attrites" are used interchangeably for "failure" and "a student who has failed.") These cost data are not exactly correct, but they reflect the general relationship among the various pipelines. This is sufficient for the numerical examples to follow.

Table 1. The Total Cost Due to Attrition for the Various Phases of Flight Training.

Source	Number of failures	Cost per failure ($)	Total cost ($)
OCS	90	5,000.00	450,000.00
API	27	18,000.00	486,000.00
Primary	79	50,000.00	3,950,000.00
Intermediate strike	12	350,000.00	4,200,000.00
Intermediate maritime	2	100,000.00	200,000.00
Intermediate helo	4	100,000.00	400,000.00
Intermediate E2/C2	1	150,000.00	150,000.00
Advanced strike	18	500,000.00	9,000,000.00
Advanced maritime	4	200,000.00	800,000.00
Advanced helo	12	200,000.00	2,400,000.00
Advanced E2/C2	3	500,000.00	1,500,000.00

Figure 1 presents a somewhat idealized "flow chart" describing the fate of 1,000 naval and Marine Corps aviation students as they progress through the flight training curriculum. The numbers contained in this chart were constructed from current data as provided by the Chief of Naval Air Training (CNATRA) Corpus Christi, TX (1). The numbers deviate slightly from the actual data but capture the essence of the flow and attrition of students for the various pipelines. As mentioned above, this report concentrates on the **advanced strike** portion of the flow chart because this pipeline is the most expensive in terms of the percentage of students who attrite and the cost per attrition.

The Navy is currently transitioning from the older T-2 and A-4 aircraft in the advanced strike curriculum to the newer T-45 aircraft. Therefore, during this transition period, the attrition rate may be higher than normal until the training regime stabilizes through experience with the T-45. A higher attrition rate (8%) than previous historical records for advanced strike is inserted into the flow chart for this reason.

The main results are presented in the next section in the form of a spreadsheet (Table 2). This analysis shows that over $2.3 million could be saved if a selection test could be found that reduced attrition from 8% to 5%. In the third section, a more detailed explanation is provided for the numbers that appear in the spreadsheet of Table 2. Of course, the numbers used in this example merely illustrate the type of analysis that can be carried out, and better numbers, if forthcoming, would result in a better analysis. Nonetheless, we believe that this kind of cost-benefit analysis is generally indicative of the untapped potential of selection tests.

The numbers given in Table 2 for the average cost of the status quo and selection testing are really just an approximation based on obtaining *exactly* 18 failures in the status quo or *exactly* 11 failures for selection testing. In fact, there is a probability distribution over the entire number of possible failures, and an exact analysis would use this probability distribution to calculate an average cost for the two scenarios being compared.

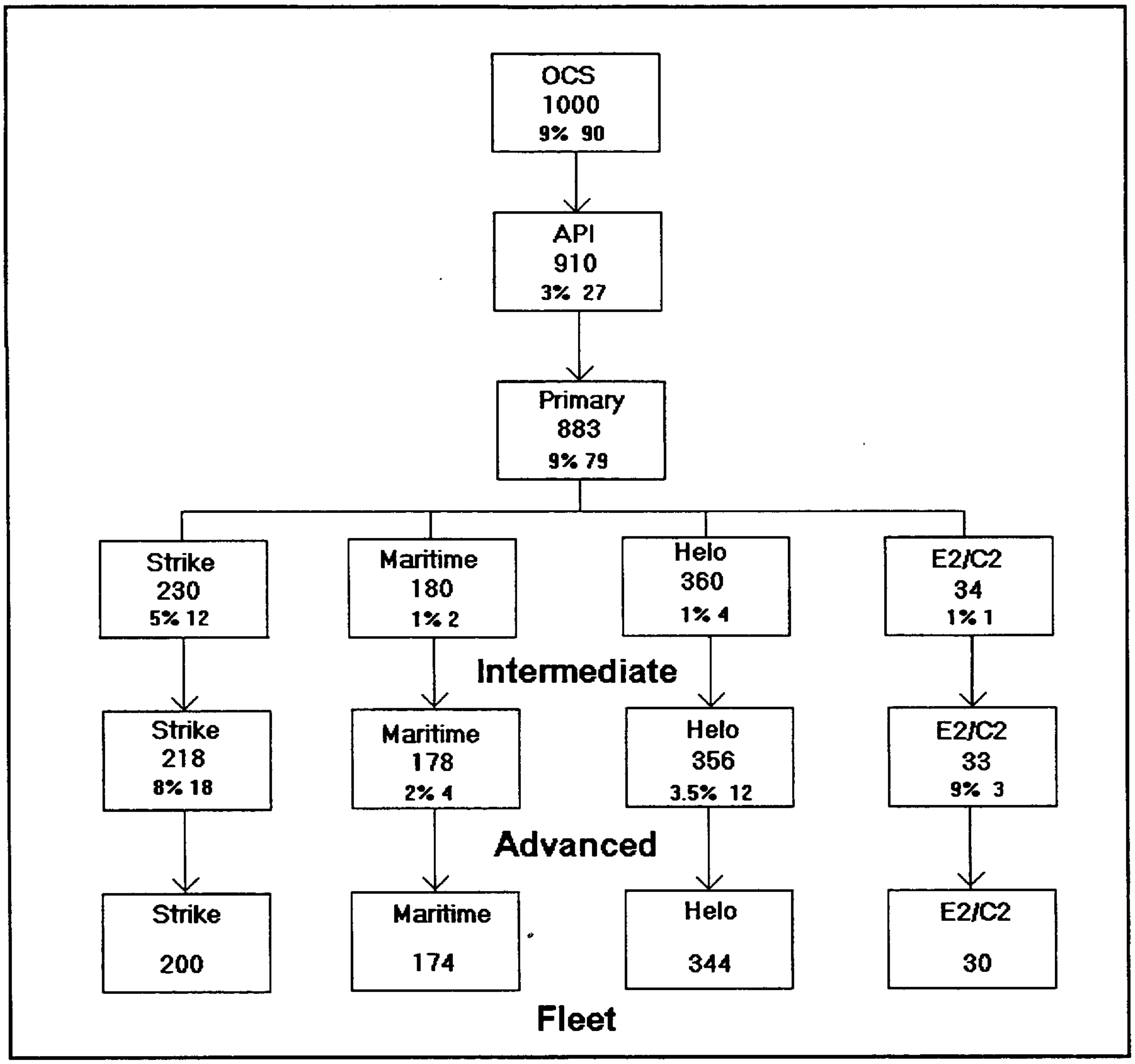

Figure 1. *A slightly idealized "flow chart" showing what happens to 1000 naval and Marine Corps aviation students as they progress through training from Officer Candidate School (OCS) until assignment in the fleet.*

The procedure for the exact calculation of the average cost for the status quo and selection testing is presented in the last section. The number of attritions that appear in the top part of the spreadsheet of Table 2 are just the expected number of attritions, and the calculation is carried out with this number. Compared to the exact calculation, the approximation used in the spreadsheet of Table 2 is fairly accurate.

A discussion of the cost-benefit trade off in advanced flight training can be found elsewhere (2). A detailed mathematical exposition of the Bayesian approach for the predictive distribution used for calculating the exact cost is given in a companion paper (3).

SPREADSHEET FOR THE NUMERICAL EXAMPLE

The *benefit* part of the cost-benefit analysis is presented first. This shows the reduction in the average number of attritions for a specified improvement due to a selection test. Given the cost per attrition, the overall average cost for the status quo can be calculated. In the same manner, the overall average cost after selection testing has been implemented is calculated. The difference between these two numbers is defined as the benefit.

Table 2. Spreadsheet Illustrating a Cost-benefit Analysis for the Advanced Strike Pipeline.

	Number in training	Attritions	Cost per attrition ($)	Average cost ($)
Status quo	218	18	500,000	9,000,000
Selection testing	211	11	500,000	5,500,000
			Benefit	3,500,000
	Cost category	Subjects	Cost per subject ($)	Total ($)
	R&D	386	1,000	386,000
	Administrative	272	2,000	544,000
	Rejection	50	5,000	250,000
			Cost	$1,180,000
			Benefit	$3,500,000
			Cost	$1,180,000
			Savings	$2,320,000

The middle of the spreadsheet in Table 2 presents the *cost* part of the cost-benefit analysis. Three costs are identified: (1) Research and Development (R&D) costs associated with setting up an experiment to test a sufficient number of subjects to determine whether the mean success rate has been raised, (2) routine costs of administering an operational version of the test for a sufficient number of candidates to meet fleet requirements, and (3) unique costs associated with a subjective judgment of costs incurred from candidates rejected by the selection test who otherwise would have passed the training curriculum.

The bottom of Table 2 shows whether the BENEFITS minus the COSTS results in a SAVINGS. If the SAVINGS is above some reasonable threshold, then an argument can be made to support funding for selection testing R&D. In this numerical example, a SAVINGS of $2,320,000 was realized.

EXPLANATION OF NUMBERS IN THE SPREADSHEET

Benefit

For the sake of this numerical example, assume that selection testing can reduce the rate of attrition from the current 8% down to 5%. We assume that a sufficient number of students are brought into the pipeline so that the number of trained aviators required for fleet assignment is at the mean of the distribution. For this example, inspection of Fig. 1 reveals that 200 students are needed to fill the operational seats for the strike community. Therefore, if 218 students are admitted into the pipeline under the status quo of 8% attrition, 200 students will be the mean number graduated. There will be, on the average, 18 attritions at the given cost of $500,000 per attrite.

This situation is contrasted with the selection testing scenario where attrition has been reduced to 5%. Now only 211 students need to be admitted into the training curriculum to obtain an average graduation of 200 students. This difference of 7 attritions between the status quo and selection testing results in a benefit of about $3.5 million.

Selection testing entails certain costs that are not present under the status quo. These must be subtracted from the benefit due to selection testing. First, there are the costs of designing experiments, running subjects, and analyzing data. The number of subjects tested must be large enough so that a reasonable estimate of the new (hopefully higher) success rate can be obtained.

The numbers that make up these R&D costs are more readily understood by viewing Fig. 2. Imagine a normal distribution of selection test scores for those subjects that eventually fail the training curriculum. This normal curve is shown drawn around a mean of 0 with a standard deviation of 1. Therefore, 99% of the selection test scores obtained by these students who failed training range from -3 to +3.

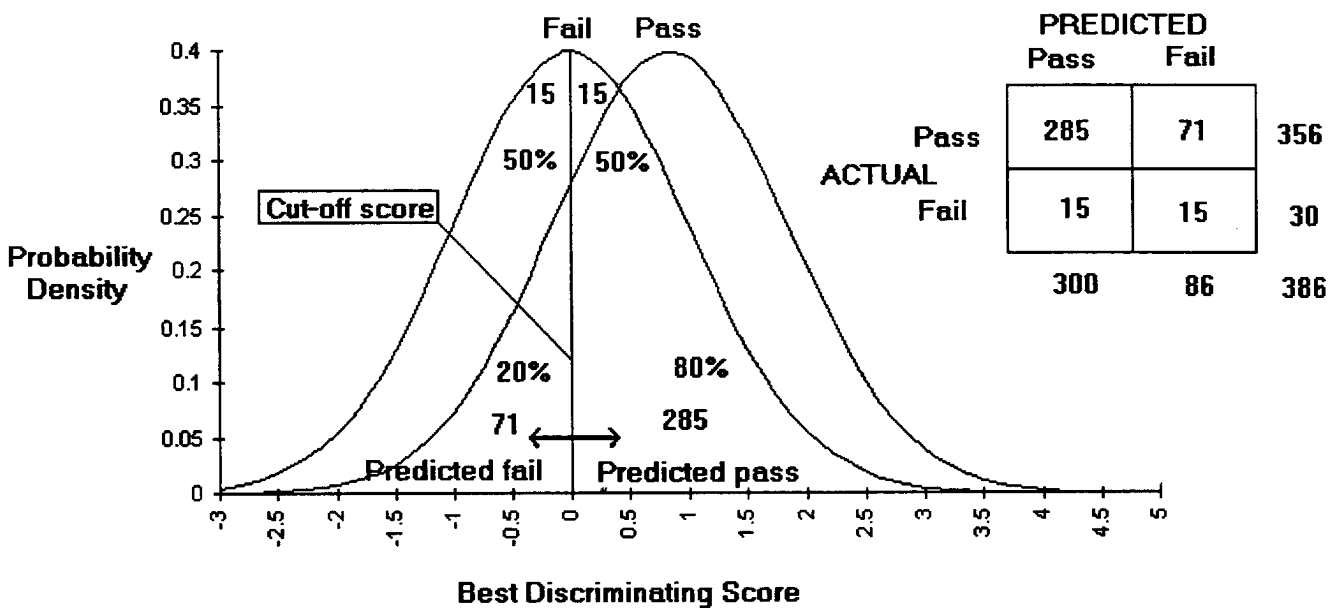

Figure 2. *A sketch of two normal distribution functions, one for scores from subjects who eventually failed training, the other from subjects who passed training. The two distributions are separated by .84 SD where each distribution has a SD of 1. The cut-off score is placed at the mean of the fail group. The table at the right summarizes the numbers of subjects in various categories.*

A line is drawn at the mean of these scores (i.e., at a score of 0). This line divides the normal curve in half with 50% of the failed students to the right half of this line and 50% of the failed students to the left half of the line. If there were 30 students in this group that failed, then 15 students would have obtained a selection score greater than 0, and 15 students would have obtained a selection test score less than 0. This line erected at the mean of the distribution of selection test scores for the FAIL group is called a *threshold*, or, *cut-off score*.

Now imagine a second normal distribution of selection test scores for the subjects who eventually passed training. If the selection test is at all helpful, the mean of this distribution for the PASS group will be higher than the mean of selection test scores for the FAIL group. For this numerical example, we want to place the mean of scores for the PASS group such that the threshold score divides the PASS normal curve into two sections, just as it did for the FAIL group. We want the section to the left of the threshold score to contain 20% of the number of students who passed and the complementary section to the right of the threshold score to contain the other 80% of the students who passed.

By consulting a table of the normal distribution, one finds a score that is .84 standard deviations below the mean of the PASS group divides off the required 20%. Since the scores for both the FAIL and the PASS group have a standard deviation of 1, the mean of the selection test scores for the students who passed training exists at +.84. Therefore, 99% of the selection test scores for the students who passed training ranges from +3.84 to -2.16.

If there were a total of 356 students in the PASS group, then requiring 80% on the right-hand side of the cut-off score results in 285 students (to the nearest integer) with the remaining 71 students representing the 20% to the left of the threshold score. We have already calculated that 15 students exist in both the left and right sections of the normal curve for the FAIL group.

If we PREDICT PASS for any score that exceeds the cut-off score and PREDICT FAIL for any score that falls below the cut-off score, then there are two ways to be correct and two ways to be wrong in the prediction. This is all conveniently summarized in the 2 x 2 table shown to the right of the two normal curves in Fig. 2. The total number of PREDICTED PASSES will be 300, of which 285 will actually PASS, resulting in the 5% attrition rate that we were seeking for this selection test. Taking into account the PREDICTED FAILS, there will be, in all, a total of 386 subjects run in the experiment, and the estimated cost for this is shown in the cost-benefit spreadsheet.

This figure for R&D costs is actually quite conservative. Normally, we would prorate, or amortize, the cost of the R&D over the life of the test, which would lower this particular cost. However, we retain this non-amortized cost figure as a worst-case scenario.

The above explanation is entirely analogous to Signal Detection Theory (SDT). The separation between the means (d' in SDT) indicates how well the test battery correlates with training performance. The placement of the cut-off score (ß in SDT) indicates the influence of prior probabilities and the values given to making correct and incorrect decisions.

The selection test scores that are normally distributed in Fig. 2 are composite scores derived from individual test scores making up the test battery. Such a composite score that best separates two groups like the PASS and FAIL groups might come from a statistical technique like discriminant analysis.

Administrative Costs

Assuming success in the experimental phase of selection testing leads to the question of an operational implementation of the selection test. How many candidates need to be tested on a recurring basis should the selection test actually be used as a screening device? The same line of reasoning used above to determine the number of subjects in the R&D phase can also be employed to determine the total number of candidates that need to be tested during routine administration of the selection test battery.

If the selection test battery has achieved the new lower 5% attrition rate, then 211 subjects are going to be admitted into the advanced T-45 curriculum. Given the argument encapsulated in the 2 x 2 table of Fig. 2, we know that 200 are predicted passes and 11 are the expected attritions. During this routine administrative testing, 50 candidates will be declared failures from those that would have passed (200 is 80% of 250) and 11 other candidates will be correctly predicted failures. Thus we arrive at a total of 272 candidates who would have to be tested on a recurring basis to provide the 200 expected successes out of 211 trainees. Operational testing requires some fixed costs for employees, testing space, maintenance, updating, et cetera, so we assign a value of $2,000 per candidate tested to arrive at this figure.

Rejection Costs

It is difficult via the selection model to assign a cost of rejecting 50 candidates who otherwise would have succeeded. We arbitrarily assign a cost of $5,000 per student to reflect the fact that some attention should be paid to this trade off in the cost-benefit analysis.

Given the circumstances in this example, it seems that over $2 million could be saved on a recurring basis through the use of selection testing specifically targeted to identify attritions in the advanced phase of T-45 training. Similar arguments could be made for other pipelines, although the savings would be less because of a lower percentage of failures and/or the lower cost of attritions.

The Exact Calculation of the Average Cost

The average cost for the status quo versus selection testing as given in the spreadsheet of Table 2 is an approximation based on the expected number of attritions for these two situations. The actual number of graduates, and, therefore the number of attritions, will fluctuate from class to class reflecting the underlying probabilistic nature of success in the training curriculum. We first present the predictive probability distribution for the status quo where the data indicate an attrition rate of 8% and then compare this with the predictive probability distribution for selection testing where the data from the experiment indicate a lowering of the attrition rate to 5%. Having these probability distributions in hand makes it an easy matter to calculate the average cost for each scenario.

Figure 3 shows the probability distribution for the status quo where no specialized selection test is used to target advanced T-45 failures. The actual probability distribution should cover the entire range of possible students graduated, *i.e.,* from 0 to 218. However, since the probability of a small number of graduates is so extremely close to zero for an attrition rate known from actual data to be around 8%, only a portion of the discrete predictive probability distribution is presented in Fig. 3. The number of graduates along the x axis ranges from 148 to 218, the maximum number of graduates possible from a class of 218. This distribution peaks at 201 graduates (the mode) and then falls off in a gradual manner for less or more graduates. Because there is a upper wall at 218 students, these distributions are slightly skewed.

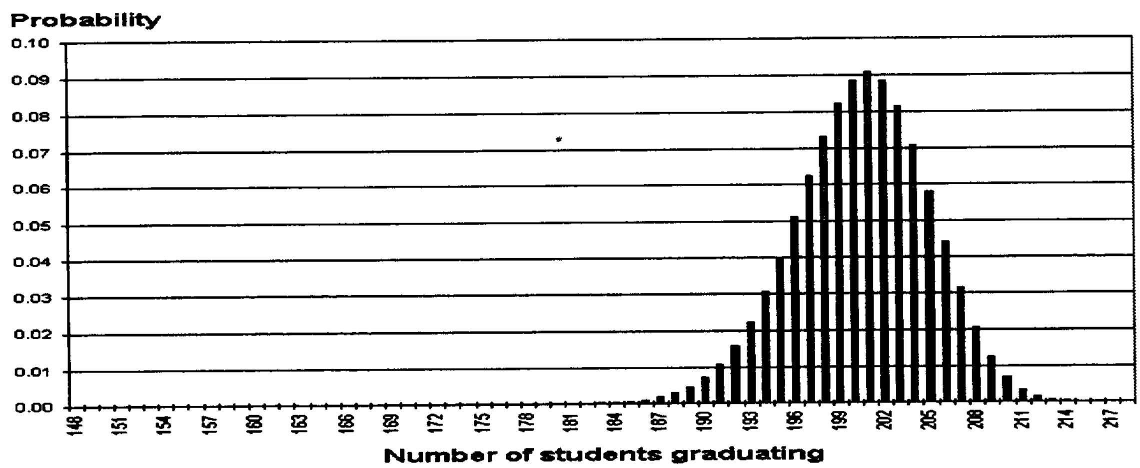

Figure 3. *The discrete predictive probability distribution for the number of graduates in the advanced T-45 curriculum based on a supposition of 8% attrition. This attrition rate is the usual rate without using any specialized selection test. The x axis consists of the number of graduates from a class size of 218. The y axis gives the probability for the specified number of graduates.*

Perusing Fig. 3 reveals a realistic probability that a training class might graduate, instead of the 200 students near the mode of the distribution, only 196 students for a total of 22 attritions. On the other hand, 208 students might graduate in another class, leading to only 10 attritions. The technical and computational details of deriving these predictive probability distributions are presented in Blower (3). For a more fundamental expository treatment of the Bayesian predictive probability distribution see Blower (4).

Figure 4 shows the comparable graph for the probability of students graduating given a new attrition rate of 5%. The x axis now extends only to 211 students because this is the new maximum class size allowable from the lower attrition rate. Although the graph still peaks at 201 students, there is some appreciable spread to fewer numbers graduating. This results from the fact that the curve is constructed from a smaller sample size, namely the 300 students used in the experiment. A smaller sample size results in more variability of the predictive probability distribution.

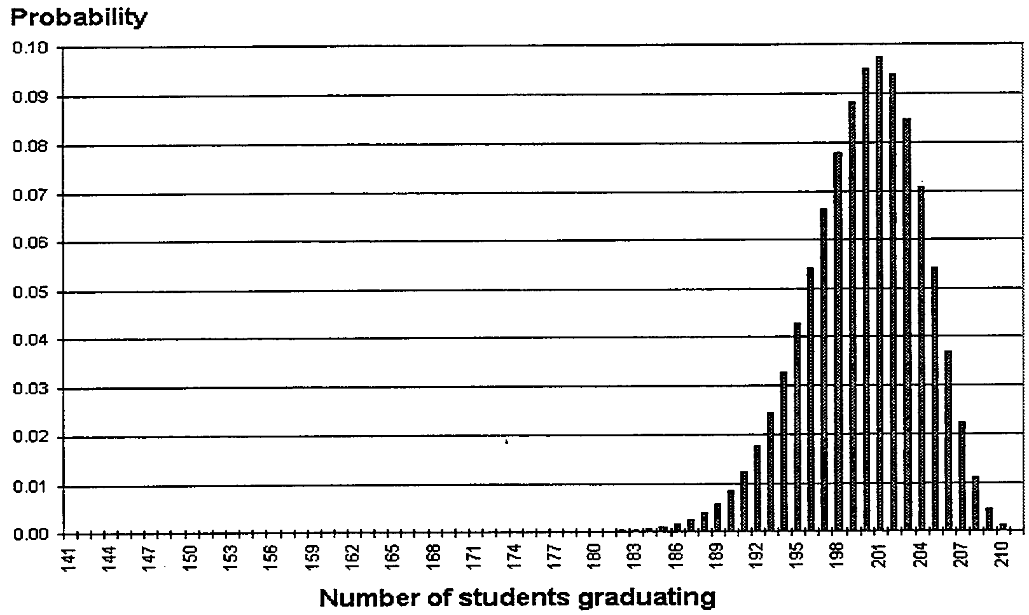

Figure 4. *The discrete predictive probability distribution for the number of graduates in the advanced T-45 curriculum based on a supposition of 5% attrition by using a selection test. The x axis consists of the number of graduates from a class size of 211. The y axis gives the probability for the specified number of graduates.*

The exact calculation of the average cost is accomplished by taking the sum over all possible graduates (in the first example from 0 to 218) of the *cost* of that number of students attriting times the *probability* of that number of students attriting. This computation is illustrated in Table 3, which looks at the range of 180 to 218 students graduating, or, in other words, from 0 to 38 attritions.

For example, the first row shows the relevant information for the situation where 180 students graduate. From a class of 218 students, if 180 students graduate, then 38 must have attrited as shown in the second column. The probability of 38 students attriting is taken from the discrete predictive probability distribution as shown in the third column. The chance of 38 students attriting is very small, but there is a large cost of $19 million attached to this number of attritions as shown in column four. The last column shows the multiplication of the probability of 38 students attriting times the cost of 38 students attriting. This computes to $492.60. This is the contribution to the overall sum for this particular number (38) students failing.

We began Table 3 where the number of attritions started to have some monetary impact on the average cost. The succeeding rows in Table 3 carry out this same computation as just described for the first row for each number of students up to a maximum class size of 218. When the last column is summed, this is the average cost for an 8% attrition rate. The exact value of the average cost as computed over the entire range from 0 to 218 students is $8,855,210.20.

Table 3. Detailed Calculation of the Overall Cost due to Attrition When the Status Quo is Maintained. The Probability for Each Number of Students Failing Comes From the Predictive Probability Density Function as Illustrated in Fig. 3.

Number of students graduating	Number of students failing	Probability of this number failing	Cost for this number failing ($)	Overall contribution to cost ($)
180	38	0.0000259	19,000,000	492.60
181	37	0.0000508	18,500,000	939.60
182	36	0.0000973	18,000,000	1,750.62
183	35	0.0001819	17,500,000	3,183.83
184	34	0.0003322	17,000,000	5,648.19
185	33	0.0005919	16,500,000	9,766.47
186	32	0.0010279	16,000,000	16,446.81
187	31	0.0017387	15,500,000	26,950.32
188	30	0.0028621	15,000,000	42,931.79
189	29	0.0045806	14,500,000	66,418.89
190	28	0.0071204	14,000,000	99,685.75
191	27	0.0107390	13,500,000	144,976.47
192	26	0.0156962	13,000,000	204,050.68
193	25	0.0222050	12,500,000	277,562.97
194	24	0.0303628	12,000,000	364,353.53
195	23	0.0400702	11,500,000	460,806.91
196	22	0.0509550	11,000,000	560,505.29
197	21	0.0623262	10,500,000	654,424.70
198	20	0.0731858	10,000,000	731,857.59
199	19	0.0823236	9,500,000	782,074.03
200	18	0.0884977	9,000,000	796,479.09
201	17	0.0906779	8,500,000	770,762.07
202	16	0.0882975	8,000,000	706,379.90
203	15	0.0814379	7,500,000	610,784.47
204	14	0.0708758	7,000,000	496,130.49
205	13	0.0579549	6,500,000	376,707.14
206	12	0.0443046	6,000,000	265,827.62
207	11	0.0314822	5,500,000	173,151.94
208	10	0.0206531	5,000,000	103,265.49
209	9	0.0124076	4,500,000	55,834.06
210	8	0.0067592	4,000,000	27,036.78
211	7	0.0032985	3,500,000	11,544.90
212	6	0.0014199	3,000,000	4,259.77
213	5	0.0005284	2,500,000	1,321.01
214	4	0.0001654	2,000,000	330.78
215	3	0.0000419	1,500,000	62.79
216	2	0.0000081	1,000,000	8.07
217	1	0.0000011	500,000	0.54
218	0	0.0000000	0	0.00
Cumulative probability		.9999999	Average cost	$ 8,855,210.20

A similar exercise can be conducted if selection testing has been implemented. The details are given in Table 4. In this case, the average cost for a 5% attrition rate is $5,645,397.76 resulting in a benefit of $3,209,812.44 for selection testing over the status quo, somewhat less than the $3,500,000 as calculated in the spreadsheet. This cost figure, of course, represents the savings before the unique costs associated with selection testing are factored in.

When the actual average cost figures as just computed are inserted into Table 2, the overall savings due to selection testing is $2,029,812.44. The approximation given by the expected number of attritions of 18 for the status quo and 11 for selection testing gives a reasonable approximation to the exact calculated benefit as performed in this section.

It is important to remember that, given the Bayesian treatment of this problem, there is a probability density function associated with both the attrition rate for the status quo and the attrition rate for selection testing. These functions are centered around 8% for the status quo and 5% for selection testing, but also allow for the possibility of lower and higher rates. So the 8% and 5% values are convenient labels locating the centers of these distributions and permit a rough approximation such as carried out in Table 2. It would be wrong to think of these two values as fixed and unvarying with no attached uncertainty. The exact calculation, which does take account of the uncertainty surrounding the 8% and 5% attrition rates through the predictive distribution, was illustrated in this section. Again, this is all spelled out in greater detail in the companion report (3).

Table 4. Detailed calculation of the overall cost due to attrition when selection testing is employed. The probability for each number of students failing comes from the predictive probability density function as illustrated in Fig. 4.

Number of students graduating	Number of students failing	Probability of this number failing	Cost for this number failing ($)	Overall contribution to cost ($)
173	38	0.0000010	19,000,000	19.84
174	37	0.0000020	18,500,000	36.55
175	36	0.0000037	18,000,000	66.51
176	35	0.0000068	17,500,000	119.56
177	34	0.0000125	17,000,000	212.21
178	33	0.0000225	16,500,000	371.75
179	32	0.0000402	16,000,000	642.46
180	31	0.0000706	15,500,000	1,094.74
181	30	0.0001225	15,000,000	1,838.24
182	29	0.0002096	14,500,000	3,039.87
183	28	0.0003534	14,000,000	4,947.43
184	27	0.0005866	13,500,000	7,918.76
185	26	0.0009581	13,000,000	12,454.81
186	25	0.0015386	12,500,000	19,232.41
187	24	0.0024274	12,000,000	29,128.74
188	23	0.0037586	11,500,000	43,224.35
189	22	0.0057061	11,000,000	62,766.66
190	21	0.0084830	10,500,000	89,071.11
191	20	0.0123337	10,000,000	123,337.33
192	19	0.0175121	9,500,000	166,364.72
193	18	0.0242413	9,000,000	218,171.55
194	17	0.0326536	8,500,000	277,555.63
195	16	0.0427103	8,000,000	341,682.24
196	15	0.0541116	7,500,000	405,837.34
197	14	0.0662173	7,000,000	463,521.07
198	13	0.0780076	6,500,000	507,049.29
199	12	0.0881247	6,000,000	528,748.20
200	11	0.0950273	5,500,000	522,650.33
201	10	0.0972703	5,000,000	486,351.64
202	9	0.0938769	4,500,000	422,445.91
203	8	0.0847129	4,000,000	338,851.43
204	7	0.0707234	3,500,000	247,531.86
205	6	0.0538842	3,000,000	161,652.53
206	5	0.0367894	2,500,000	91,973.56
207	4	0.0219464	2,000,000	43,892.71
208	3	0.0110239	1,500,000	16,535.92
209	2	0.0044013	1,000,000	4,401.30
210	1	0.0012696	500,000	634.80
211	0	0.000000	0	0.00
Cumulative Probability		.9999999	Average Cost	$ 5,645,397.76

REFERENCES

1. CNATRA Message. MSGID/GENADMIN/CNATRA N3. Subj: ATR Distribution. Ref: A RMG CNATRA 181603Z July 95.

2. Blower, D. J. *Performance-Based Testing and Success in Naval Advanced Flight Training*. NAMRL-1378, Naval Aerospace Medical Research Laboratory, Pensacola, FL,1992.

3. Blower, D. J. *A Quantitative Framework for Conducting Cost-Benefit Analyses of Selection Testing*. NAMRL-1397, Naval Aerospace Medical Research Laboratory, Pensacola, FL, 1996.

4. Blower, D. J. *An Introduction to Scientific Inference: A Tutorial Emphasizing the Maximum Entropy and Bayesian Approaches*. Published privately by the author. Patari Press, Pensacola, FL, 1997.

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13. ABSTRACT *(Maximum 200 words)*

This report presents a numerical example showing how selection testing can reduce costs in advanced T-45 training. Selection testing provides savings by reducing the rate of attrition. With reduced attrition, fewer students are required to enter the training curriculum to achieve a set number of graduates to fill operational seats. Balanced against this positive impact are at least three factors associated with selection testing that must be taken into account in any cost-benefit analysis. These are 1) R&D costs, 2) administrative costs, and 3) costs associated with rejecting qualified applicants. It is shown that, under certain readily quantifiable circumstances, selection testing might save over 2 million per T-45 class. The major goal of this report is to provide a quantitative framework for the rational discussion of selection tests as a prelude and partner to military training curricula.

14. SUBJECT TERMS
Selection, Flight training, Cost-benefit analysis, Bayesian predictive distribution

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